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ABSTRACT

There has been a large amount of research on the relative effects of cooperative, competitive, and individualistic learning on achievement and productivity. This paper reports a study designed to determine the effect of cooperative learning strategies on mathematics achievement of 7th graders. Based on school records indicating whether a student had participated in the cooperative learning strategies group or had received individualized/competitive instruction, 50 seventh-grade students were selected from an elementary school located in a low socioeconomic neighborhood in Chicago made up of all minority students. Scores on the mathematics portion of the Iowa Test of Basic Skills administered in the Spring of 1991 and 1992 were utilized to compare the mathematics achievement of the students in the two groups. T-tests performed on the pre-test and post-test data indicated that no differences existed in the groups prior to instruction, but that the cooperative learning groups performed significantly higher on the post-test. These findings confirmed results of similar studies. The paper concluded that cooperative group learning strategies are more effective in promoting mathematics achievement. (MDH)

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The Effects of Cooperative Learning With Intergroup Competition on The Math Achievement of Seventh Grade Students

John Reid

One of the most widespread and burdensome tasks in education is the accommodation of heterogeneity in student preparedness and rate of learning. The dilemma surfaces when a lack of necessary skills exist or mastery has already been attained. Both circumstances involve time being wasted, yet in most classrooms students fall into either category.

Traditionally the common means of dealing with heterogeneity has been through various forms of ability grouping. These would include tracking/curriculum placement, special education and gifted classes. According to decades of research studies (Esposito 1973) tracking has failed to upgrade achievement. The same holds true for special education and gifted classes. Neither seem to have significant achievement benefits.

Other predominant means of meeting diverse learning needs are through the use of individualized instruction and competitive structures. Evaluative studies have not, generally, found benefits of these strategies for student achievement.

Since the aforementioned methods have been put to the test but have been found wanting researchers must turn their attention and redirect their focus to more effective pedagogical strategies. Cooperative group strategies are under investigation in hopes that they will effectively meet the educational needs of our ever changing interdependent society.

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Since the 1920's there has been a great deal of research on the relative effects of cooperative, competitive and individualistic learning on achievement and productivity. Until the decade of the '80's social scientists disagreed as to the conclusions that may have been drawn from the numerous studies conducted.

Four structures are commonly examined: (a) cooperation, (b) cooperation with intergroup competition, (c) interpersonal competition, and (d) individualistic efforts. There are two major approaches which fuel these conditions, one stemming from Lewin's theory of "Intrinsic Motivation" (1935) and the other from the behavioral learning theory of "Extrinsic Motivation".

Deutsch (1949, 1962) defined, intrinsically, a cooperative social situation as one where the individual goals are linked together and there is a positive correlation among their goal attainments. A competitive situation is one in which the goals of the individual are attained at the expense of the other participants. Finally in an individualistic situation as individual has no influence on whether other individuals achieve their goals.

Kelley and Thisbut (1969) defined the structures from an extrinsic reward-base. A cooperative structure rewards individuals based on the quality of group work. In a competitive structure one individual is rewarded maximumly, others receive minimum rewards. Individualistic structure rewards the individual. Thus most of the research conducted stems from one of these theoretical points of view.

Prior to 1987 three major controversies had arisen from research studies that examined the effects of cooperative, competitive and

individualistic efforts on achievement. One controversy is cooperation vs competition in regards to higher achievement. Michael (1977), a psychologist insisted that competition promoted superior achievement to cooperation. Sharon (1980) concluded just the opposite. A second controversy pits cooperation against individualistic efforts. Hayes (1976) was convinced that individual reward structure promote higher achievement than do group reward structure. Others conclude the opposite. A third controversy is whether intergroup competition is necessary in order for cooperation to be effective. Slavin holds the latter view. Johnson and Johnson (1874, 1975) studies concluded that intergroup competition is irrelevant to the efficiency of cooperative activities.

In 1981 a meta-analysis of the "Effects of Cooperative, Competitive, and Individualistic Goal Structures on Achievement" was conducted by 5 of the authorities in the arena of psychological and social research. The results of the analysis tended to bring some conclusiveness to previous research. The study reviewed 122 studies and compared the relative effectiveness of cooperation, cooperation with intergroup competition, interpersonal competition and individualistic goal structures in promoting achievement and productivity in North American samples. The studies yielded 286 findings. The results are as follows:

1. Cooperation without versus cooperation with intergroup competition yields no real difference in achievement.
2. Cooperation versus competition indicates that co-operation promotes higher achievement by 65 to 8.
3. Cooperative with intergroup competition versus inter-personal competition reveals that cooperative with

intergroup has a slight edge in 19 of 14 studies.

4. Cooperation versus individualistic effort shows cooperation promotes higher achievement by 108 to 6 (with 42 no differences).
5. Cooperation with intergroup competition versus individualistic efforts showed cooperation with intergroup competition promoting higher achievement than individualistic efforts by 20 to 1.
6. Competition versus individualistic efforts shows no significant differences. (9 to 18 with 38 no differences).

From the above results it was concluded that the cooperative strategies significantly affected student achievement. It was voted, however, that the one variable that seemed to be most effective in the cooperative design was the reward variable. In order for the cooperative structures to have any significant impact on achievement group rewards had to be incorporated.

Slavin's (1983) research supports these earlier findings. After his study of small groups working to learn academic materials, he purported that only cooperative learning methods that provide group rewards based on group members individual learning consistently increased student achievement more than controlled methods. Another variable of importance cited by Slavin's study is individual accountability. Individual accountability must be present in order for the cooperative strategy to be effective instructionally.

Cotton and Cook (1982) and McGlynn (1982) attack the meta-analysis findings cited earlier by pointing out a contradiction which found

statistically significant interactions on productivity and achievement outcomes between cooperation, competition and 10 different factors, including type of task, resource sharing, task interdependence and other factors (Cotton and Cook).

Slavin's (1983) review of research, unlike the meta-analysis, had individual achievement as a dependent measure. Less than 1/3 of Johnson's et al meta-analysis had this variable. Slavin confines his review of research to student achievement in elementary and secondary schools. After the review of 46 studies, he concluded that the 2 facotrs (mentioned earlier) group rewards and individual accountability must be present in order to be more instructionally effective than traditional methods. All but 4 of 32 which used the combination of these factors had significantly higher academic achievement. Only 1 of 14 that failed to included those 2 factors had positive achievement effects compared with control conditions.

As recently as 1989 a nationwide evaluation of effective programs using Individualized Instruction and cooperative learning structure was published by Slavin, Karweit and Modde, in their book "Effective Programs For Students At Risk". The following programs were listed as presenting convicting evidence of effectiveness. Only 1 used a control group design

1. Matteson Four Dimensional Reading Program;
2. Andover's Individualized Reading System;
3. Systematic Teaching and Measuring Mathematics

Two cooperative learning programs, Team Accelerated Instruction (Slavin, 1985) and Cooperative Integrated Reading and Composition (Maddin, Slavin and Stevens, 1987) were listed. Four studies using control group designs were used.

Slavin (1981) also gives strong evidence in his case study of

Student Team Learning (STL) in support of the cooperative reward structure. Slavin further notes that the basic STL methods of Student Team Achievement Division (STAD) and Team Games and Tournament (TGT) can be used to effectively enhance achievement in most educational settings and disciplines, particularly math.

In the field of mathematics in the elementary and high school recent research strongly supports theories concerning the effectiveness and motivation associated with intergroup competition of small cooperating groups (Sherman and Thomas 1986). A pre-test/post-test design was used with a control group. Slavin (1985) studies the effect of Team Assisted Individualization (TAI), Ability Group Active Teaching (AGAT), the Missouri Mathematice Program (MMP) and untreated control classes on mathematics achievement of 3rd through 6th graders. The former three outperformed the latter in nearly every area of mathematical achievement. TAI, which is a cooperative learning strategy, had the most significant overall effect in mathematics achievement.

Literature on research relating to the effect of cooperative strategies on mathematics achievement appeared to be sufficient. The available research appears to suggest that cooperative grouping strategies do increase the mathematics achievement level of the participants. Although many of the studies reviewed didn't delve into the particular area of mathematics, certain studies seemed to allow the extrapolation of evidence into the strata of mathematics (Slavin 1983). Caution was suggested in terms of the presence of essential variables without which could nullify the effects of the cooperative strategy.

It was also pointed out that at certain times and situations

individualization and competitive forms of instruction, though apparently rare in comparison to cooperative learning, are deemed as effective or more effective. One such case would be rote mathematical drill.

Because of the obvious lack of the use of cooperative learning strategies in our public schools today and the apparent lack of achievement in mathematics in the same, a great deal of research exploration is still needed. Even more importantly looms the issue of how to get educators to accept "another panacea" from those that they pereive as dwelling in "ivory towers" (Reid 1992). The reviewed evidence suggests that though the task might appear monumental, the results might be worthwhile.

Question of the Study

What is the effect of cooperative learning strategies on mathematics achievement scores of 7th graders?

The population for this study will involve 70 seventh grade students. These students attend the Colman Elementary School which is located in a low socioeconomical neighborhood in Chicago's Grand Crossing area. All of the population are minority students.

From the 70 students, the school records show that 41 participated in the cooperative learning strategies group and 29 received individualized or competitive instruction. Twenty-five students were selected from each sub-population.

Method of Data Collection

The Iowa Test of Basic Skills is administered at Colman School every Spring. Two samples were identified using school records of those students receiving instruction from the cooperative learning math instruction group and those receiving instruction from a conventional, trditional individualized competitive structured classroom. The mathematics results of the ITBS administered during the Spring of 1991

and 1992 will be used in this study. The pre-test/post-test design will be used.

Finding of the Study

Our samples for this study included 7th grade students from Colman School. The 1991 Iowa Test of Basic Skills was used as a pre-test measurement and the ITBS 1992 was used as a post-test. All 7th graders are administered the ITBS each spring. Two groups of students receiving different methods of instruction were identified. One group of 30 students received a traditional whole group/individualized instruction (see definition). Another group of 40 students received instruction using a cooperative structured approach. In order to get an equal representation from each group a stratified sample of 25 were randomly selected from each group. A t-test was administered to determine the initial equality of each group.

Table 1 summarizes the results of the analysis:

Table 1

Means, Standard Deviation, and t-Tests for the Whole Group Instruction and Cooperative Structure for Mathematics Achievement Scores

(N = 25)

Pre-Test	Whole Group	Cooperative Group	t
M	5.424	5.59	.69
SD	.81	.92	
Post-Test	**Whole Group**	**Cooperative Group**	**t**
M	6.236	6.896	2.35*
SD	1.14	.84	

Table t = 2.021 Reject Ho 2.35 2.021 at .05 level

*significant at .05 level

Initially there was no significant difference (pre-test) between the two groups. The whole group had a mean score (pre-test) of 5.424 5.4 and the cooperative group started out with a 5.59 or 5.6. In the spring of 1991 these 2 groups were equivalent.

After 1 year of exposure to the cooperative learning strategy the mean score elevated to 6.896 6.9 where as the whole group's mean ascended to 6.236 6.2.

The t scores for the 1992 year display a significant change in athematics scores for the 2 groups. The t scores (P .05) are 1991 (.69) and 1992 (2.35).

According to the data the null hypothesis is rejected: seventh graders taught mathematics using cooperative learning strategies will not obtain significantly higher mathematics achievement scores on the ITBS than those using whole group (individualized/competitive) strategies.

In general the results of the findings of the study, "The effects of cooperative group learning with intergroup competition on the math achievement scores of seventh grade students", supports the mass of recent research. The research findings that most closely resemble this study is Slavin's (1983). His Student Team Learning (STL) methods were studied and compared to more traditional pedagogical approaches to learning. From the results it was concluded that the emphasis of the incentives (rewards) and individual accountability had an impact on the effectiveness of the cooperative learning structure and that it was the presence of these factors that made the structure impactful on achievement. Because of the presence of these factors in this study the same conclusion might be extrapolated. Furthermore it may be concluded, conversely, that had the cooperative structures been void of these two factors the results would not have been statistically significant.

The results of Slavin's (1985) findings, in which he compares the effects of Team Assisted Individualization (TAI), Ability Group Active Learning (AGAL), the Missouri Mathematics Program (MMP) and the untreated control group, also resembles this study. The students in the cooperative strategy of TAI significantly outperformed the three other cooperative structures just as this study's cooperative strategy outperformed the other method of instruction.

The findings, also, support several aspects of the evidence listed in the meta analysis done by Johnson et;al (1981). Two aspects are: (1) cooperation versus individualistic effort showed cooperation promoted higher achievement by 108 to 6, (2) cooperation with intergroup competition versus individualistic efforts showed that cooperation with intergroup competition promoted higher achievement than individualistic

efforts 20 to 1.

Overall the findings seem to have important practical implication for education. Given the results of recent studies and the conclusion of these findings there appears to be strong evidence to support the superiority of cooperative learning strategies, in general, and cooperative learning strategies with intergroup competition in particular in promoting achievement. Because of the apparent flexibility in cooperative structures it can be construed that these strategies can be used in most academic disciplines. Through the use of properly employed incentives and individual accountability factors, cooperative learning with intergroup competition may have the potential to significantly impact education in the near future. It must be interjected that even in the studies in which there was no significant impact on academics other positive effects have been found such as student self-esteem, race relations and academic acceptance of mainstreamed academically handicapped students.

The challenge for future research on cooperative learning and student achievement will be to understand how the cooperative incentives function as motivators, to understand how these incentives interact with the various tasks, to aid the student achievement and to understand how student behavior is effected by these incentives. There seems to be a continuing need for the development of new cooperative strategies to help solve the problem of the seemingly increasing interdependence of our society and the ever existing problem of heterogeneity. Obviously a need exists to revolutionize, reform or at the least modify the incumbent methods.

This study incorporates it's own cooperative design. Historically (at least for the last seven years) this design has yielded similar

results as the findings. This study is the first attempt to "formally" give empirical data that supports these results. The flexible cooperative structures allowed this researcher to insert the various incentives and aspects of individual accountability which, in this researchers opinion, significantly enhanced the level of achievement. Henceforth, this design will be known as the Mathematics Team Competition (MTC). It is believed the former results warrant a deeper look into this design as a viable cooperative learning strategy.

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